Co-ordinated by ECMWF

CoCO2
Prototype system for a Copernicus CO_2 service

Monitoring anthropogenic CO_2 (and CH_4) emissions

From science to **operational** services

Glen Peters (CICERO, Norway)
1/03/2023

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958927.

Estimating fossil CO_2 emissions (bottom-up, inventory-based)

Fossil CO_2 emissions are generally estimated from statistical (activity) data

- Tonnes of coal *times* emission per unit coal
- (reality is a bit more complex…)

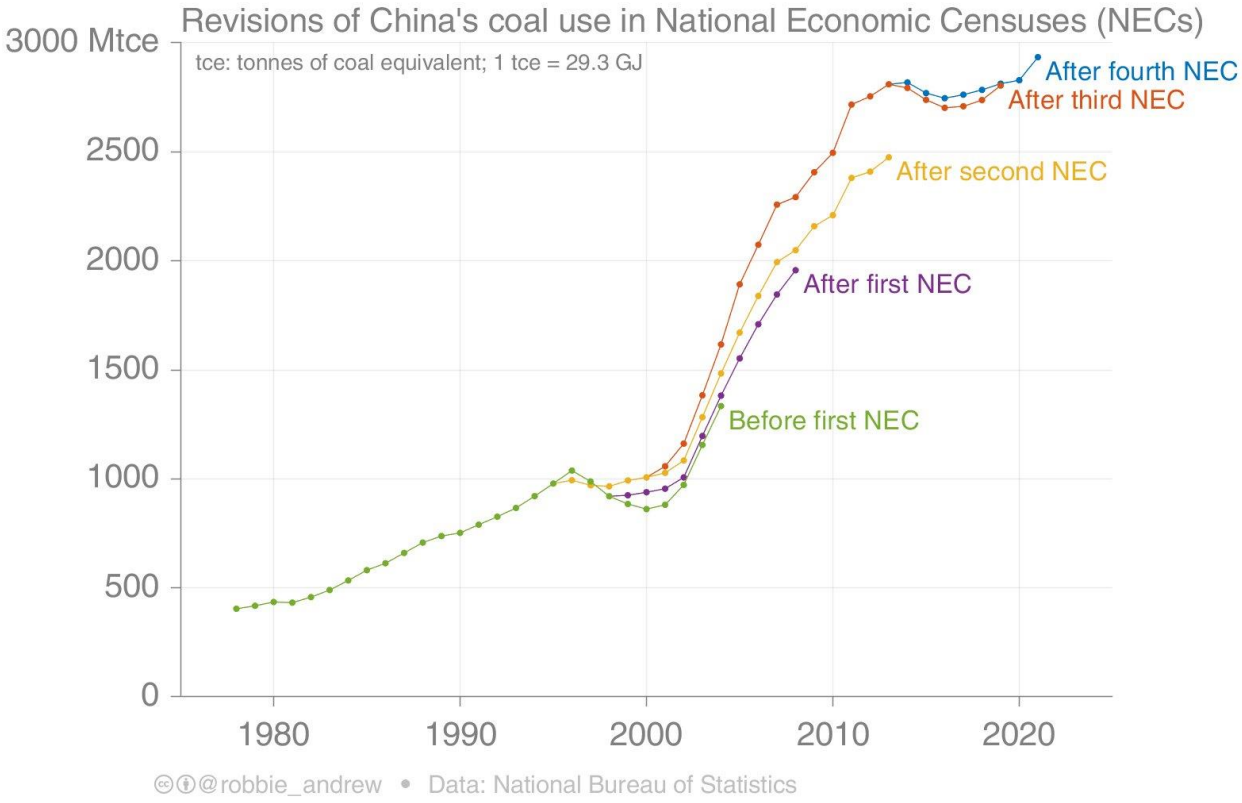
We (think) we can estimates country-level fossil CO_2 emissions to within a few percent!

We have some uncertainties:

- Are we *sure* our estimates are accurate?
- Do all countries have equally good estimates?
- What about smaller scales (cities, facilities)?

Land CO_2 fluxes and CH_4 are *way* more complex…

What about using observations instead?



Update of [Korsbakken et al (2016)]

Estimating CO_2 emissions (top-down, observation-based)

Could we use observations to estimate CO_2 emissions?

- Not so simple…

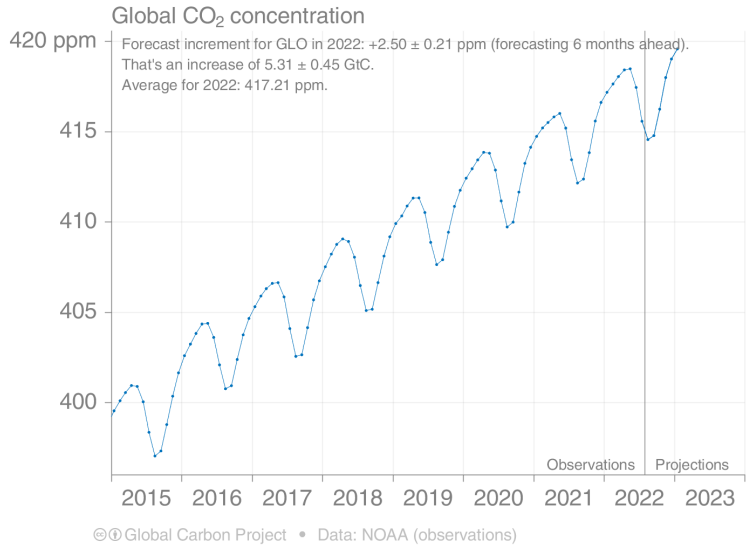
CO_2 is long-lived and has complex interactions:

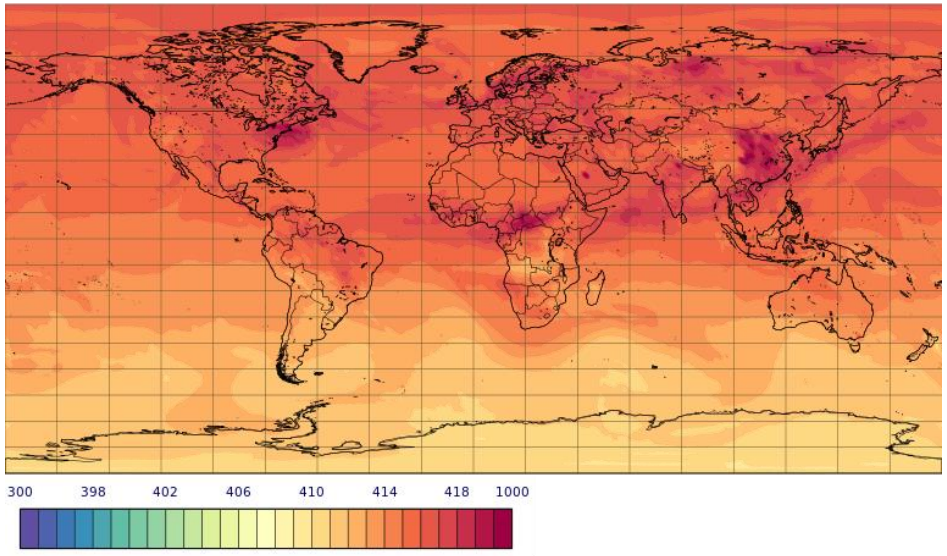
- CO_2 comes from a variety of time periods
- CO_2 comes from a variety of sources (fossil, biogenic)
- We breath out CO_2, plants breath CO_2 in (respiration)

We monitor over large areas (countries) and specific time periods (annual)

- Observations may be at specific locations & different temporal resolutions

The value of CO_2 observations only comes when linked to other observations and models…



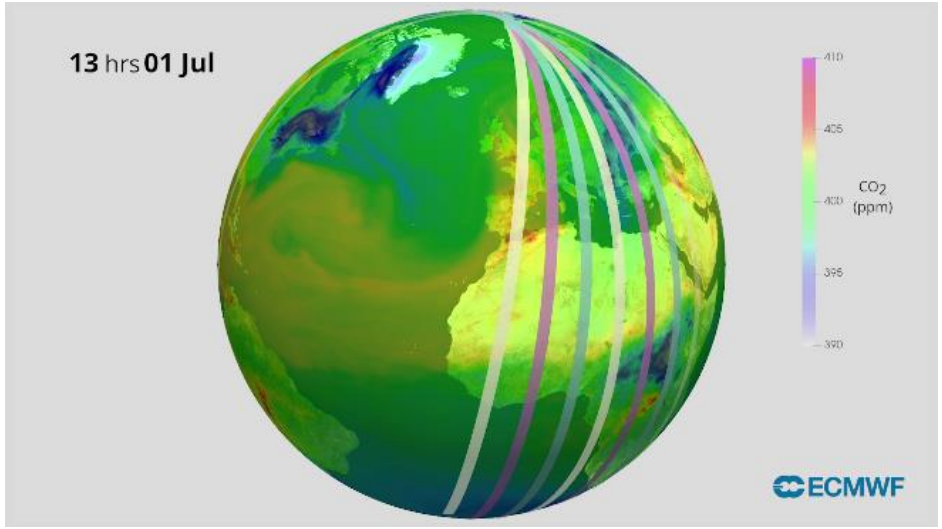


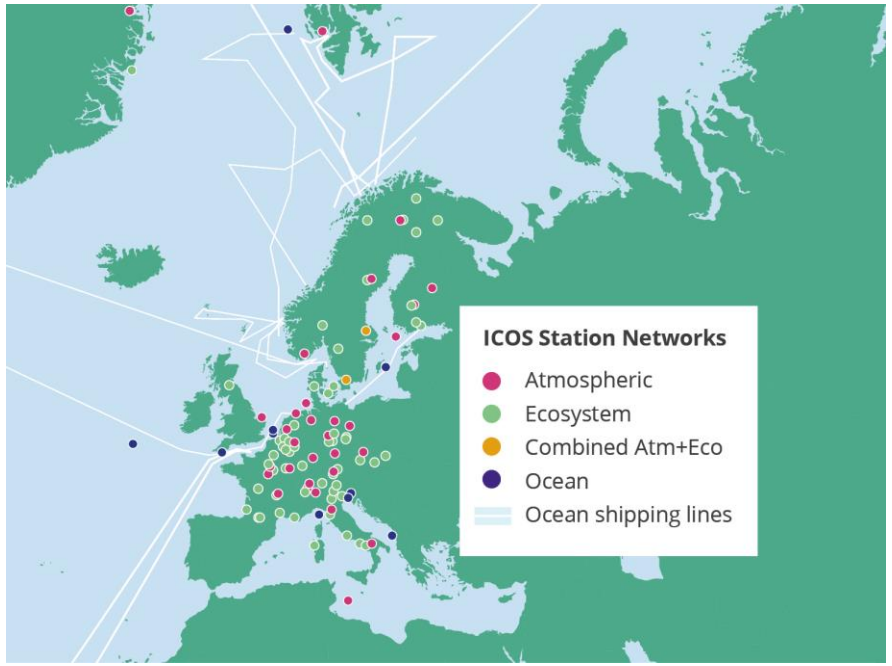
Total column of carbon dioxide [ppmv] for Thursday 28 November 2019.
(Credit: Copernicus Atmosphere Monitoring Service, ECMWF)

Each observation is one more piece in the complex puzzle

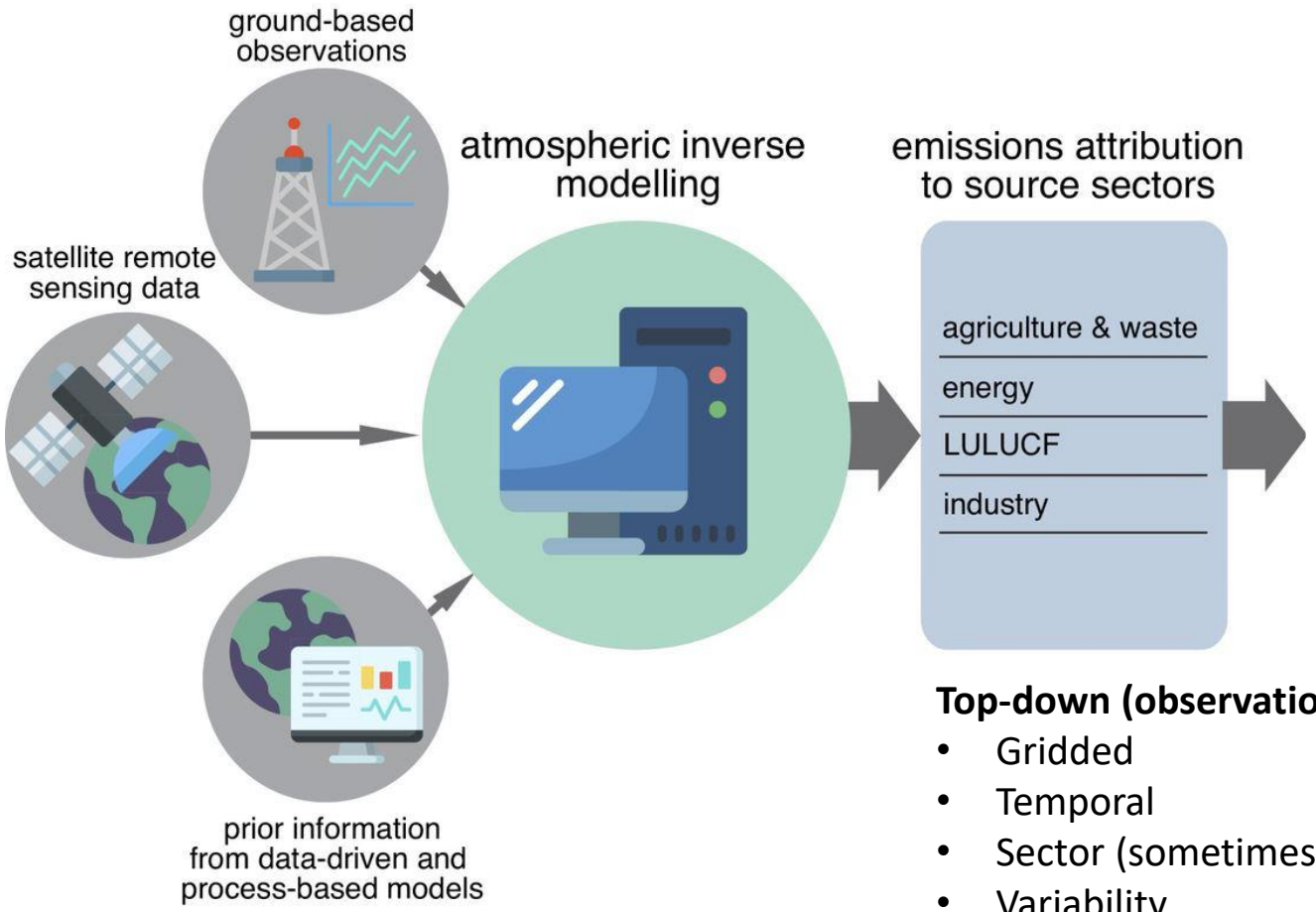
Satellites provide continuous and broad coverage, but at specific locations, at specific times, in specific conditions.

Other observations are essential to provide calibration, fill gaps, provide complementary information (e.g., a fixed site measuring fluxes), complementary methods, etc





A model is needed to reconcile all the observations!

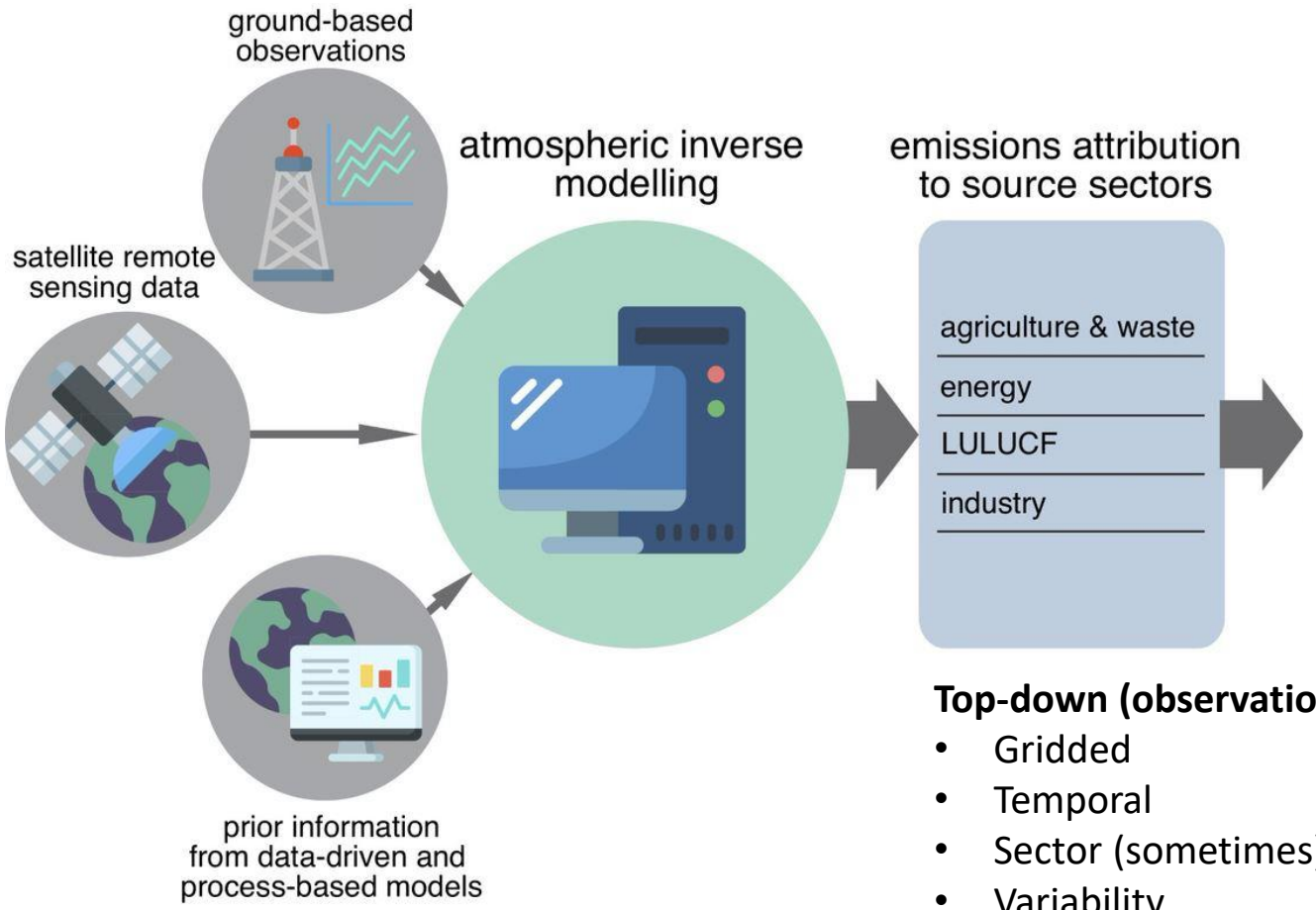


Top-down (observations)

- Gridded
- Temporal
- Sector (sometimes)
- Variability
- Scientific research

Figure by Rona Thompson (NILU)

Two methods to estimate CO_2 emissions



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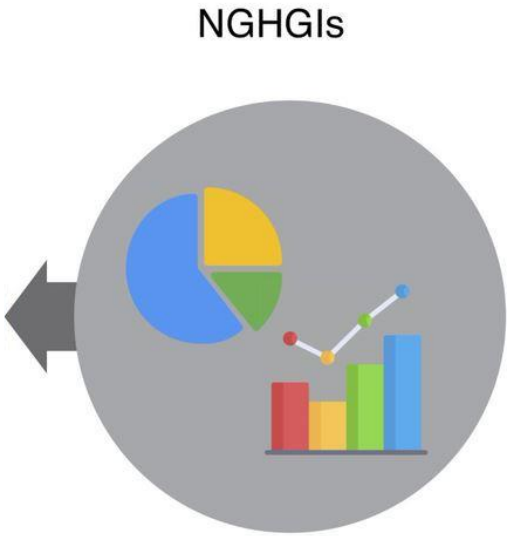

Bottom-up (inventory)

- Country (generally)
- Annual
- Sector
- Averaged
- Official reporting

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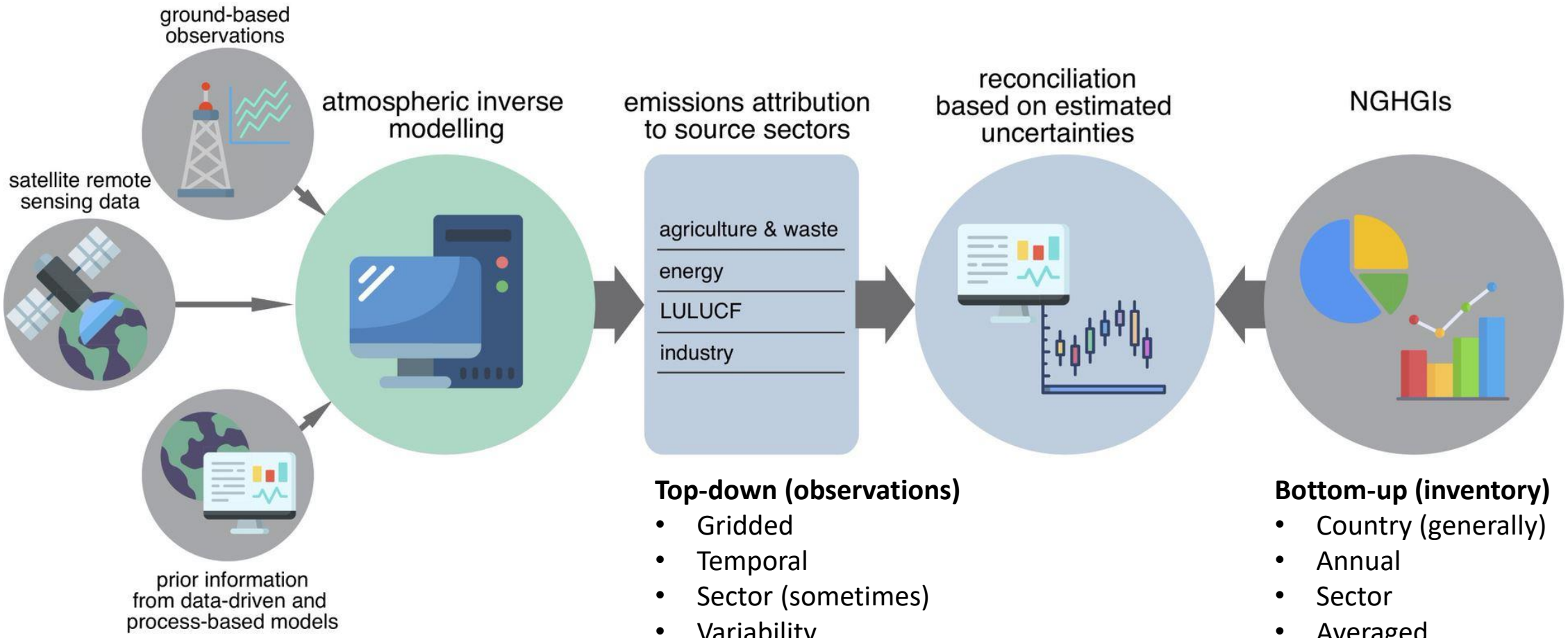
Two methods to estimate CO_2 emissions



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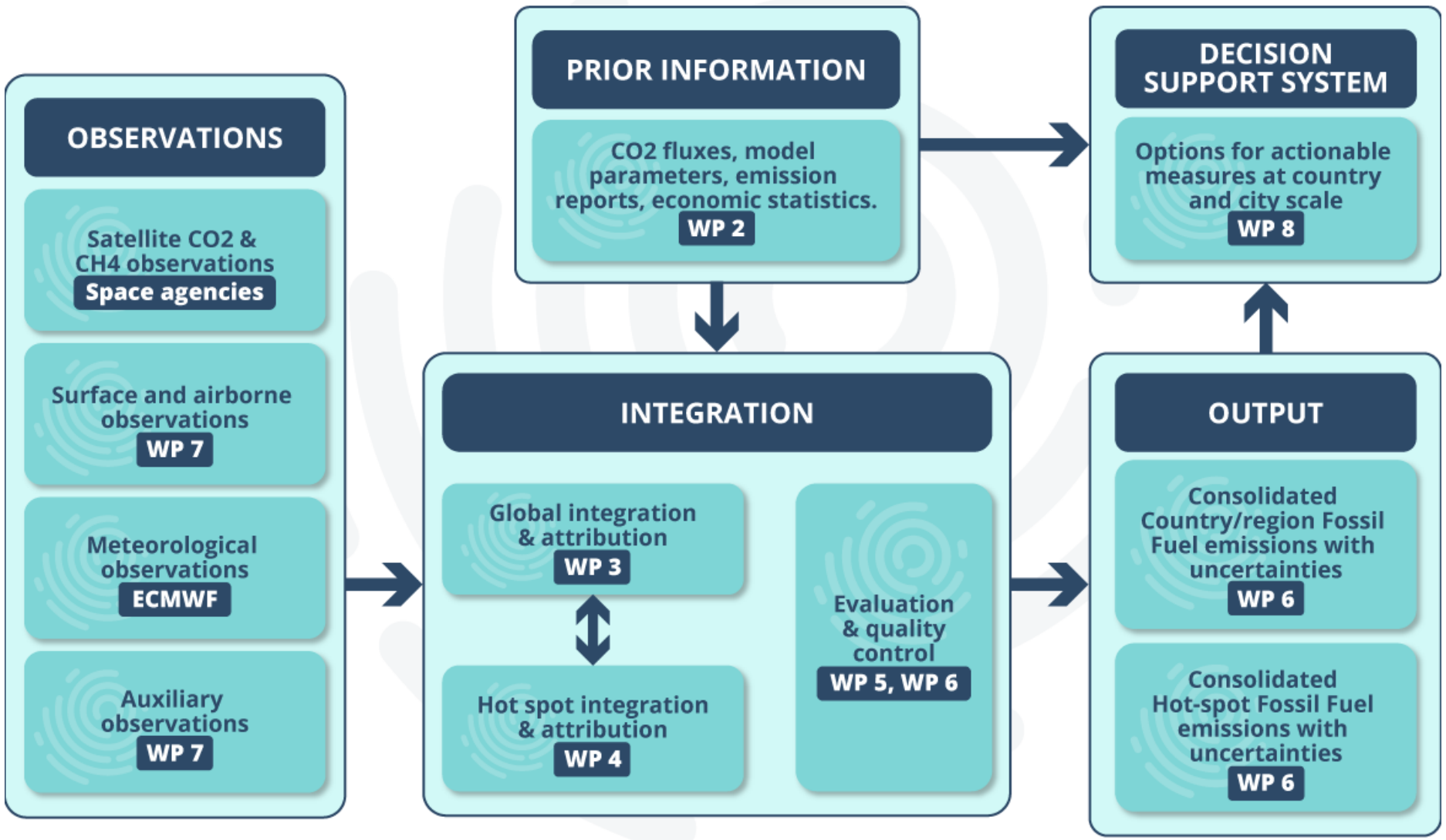
CoCO2: Developing CO_2 monitoring & verification support (CO2MVS)



The challenges across scales

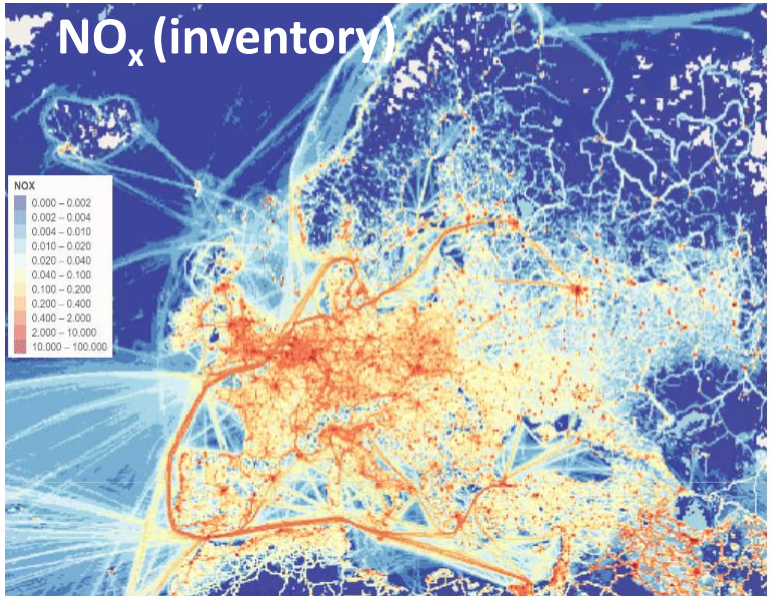
Many applications of inventory- and observation-based estimates are country level

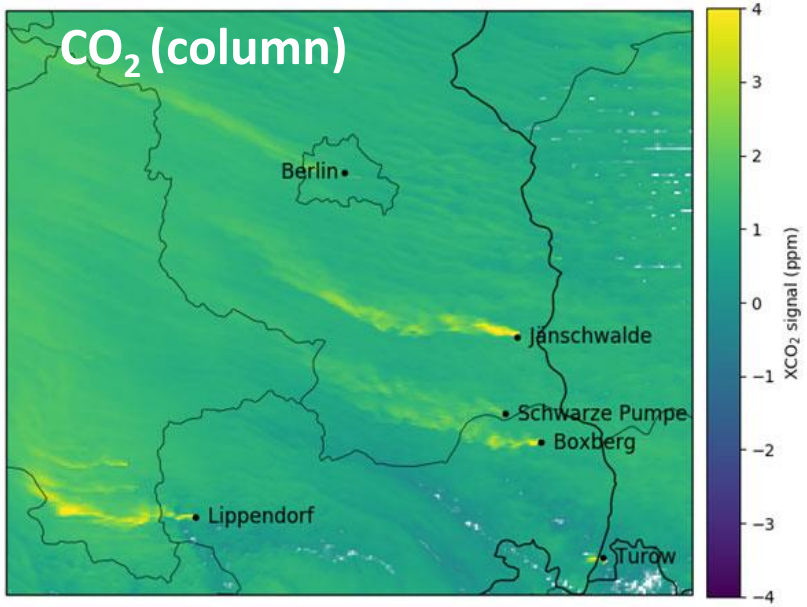
- What can be done at the city-level?

City-level leads to new challenges:

- Inventories with high spatial and temporal detail
  - Confidential data, system boundary issues, etc
- Strong observation network
  - Depending on city location, structure, etc, different observations / methods may work better
- Point sources require methods to detect plumes against the background
  - An isolated power station versus an industrial facility within a city

An active area of research is how best to reconcile different types of inventory- and observation-based estimates across scales





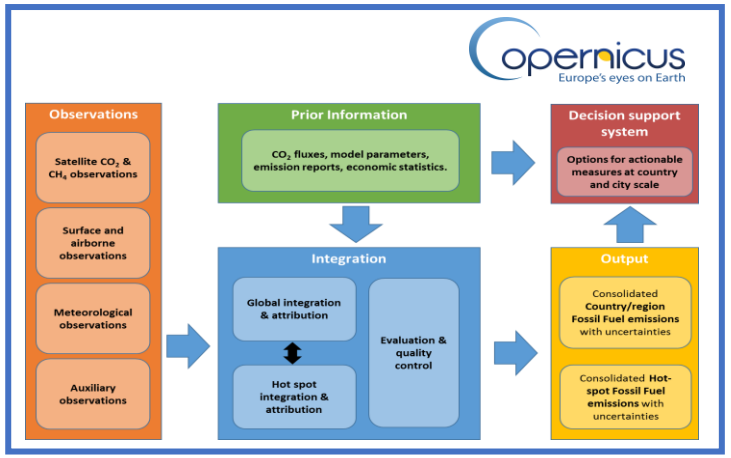
User engagement for co-designed user services

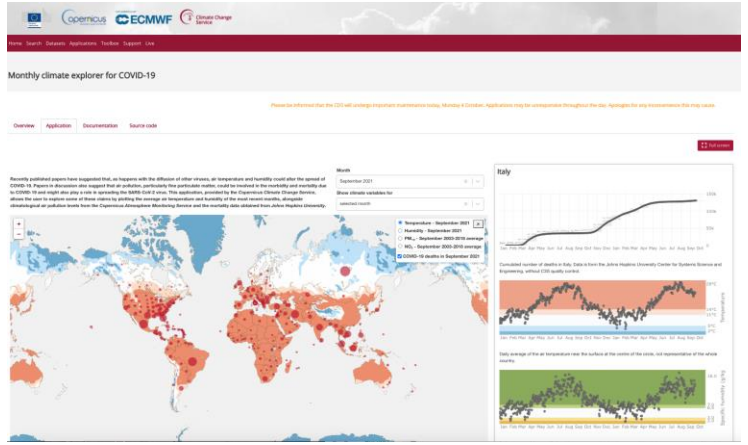
Decision Support System

How to take the complex information generated from observations and models into a format that is useful to the user community?

- What information is needed and in what format?
- What questions are users trying to answer?
- What observations and methods can answer particular questions

Please comment on the CoCO2 Decision Support Blueprint: https://coco2-project.eu/node/355





European Commission
CLIMATE ACTION

ICLEI Local Governments for Sustainability

IG3IS Integrated Global Greenhouse Gas Information System

United Nations Framework Convention on Climate Change

CoCO2

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This presentation reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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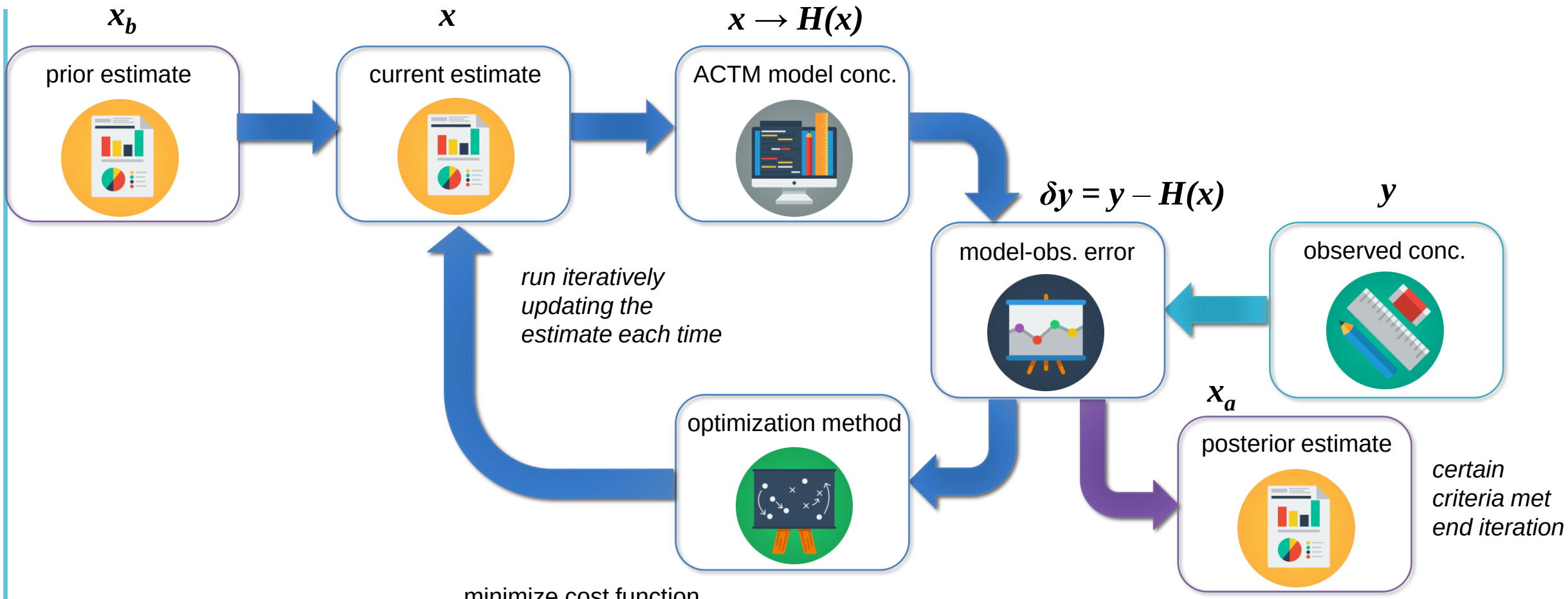

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